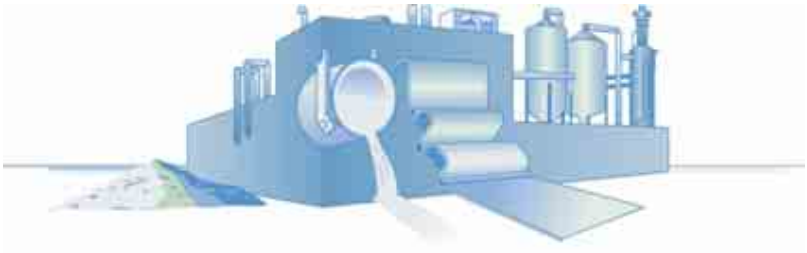
Industrial Materials for the Future New Projects FY04



Program vs. Project Management

DOE-EERE

- Eleven program areas
  - ITP – IMF sub-program
- "One" project management center
  - Golden, NETL, eight ROs
- Uniform project management
  - Policies and procedures

Solicitation and Selection Process

- Solicitation
  - Joint effort
    - HQ, Field Office
    - Project management, acquisition, financial assistance
- Program opportunity notice
- Grants.gov site – electronic submission
- Evaluation criteria
- Team of independent experts
- Ranking, qualifying list
- Selection list

Award Negotiation Process

- Financial Assistance
  - Not contract
  - Cost share required
- Cooperative agreement
  - Not grant
  - Substantial DOE involvement
- Compliance with Federal acquisition regulations (FAR)
- Contracting officer/specialist
- COTR
- Project officer/manager
- Evaluate proposed work, budget
- Certify adequacy, reasonableness

Statement of Work

- Background
- Objective
- Work breakdown/structure
  - Tasks/subtasks
  - What, who, how
  - Level of detail – budget justification
- Project schedule/milestones
- Deliverables

Budget Summary & Details

- Forms: DE4600.4 / SF424A / PF20
- Total budget broken down by:
  - Project year (quarters)
  - Federal/non-Federal
  - Cost elements
    - Personnel
    - Equipment
    - Materials/supplies
    - Travel
    - Contractural
    - Other
- Further details for categories - list of items

Contractual

-Includes all project team members

- National Laboratories
  - S.O.W.
  - Copy of FWP
  - Budget summary, details
- Universities and Companies
  - S.O.W.
  - Budget summary, details
- Cost Share Participants
  - Same/similar documents
  - Commitment letters
  - Description of “in-kind” contribution
  - Enough detail to justify
  - Budget

Budget Details

- Personnel
  - Job category
  - Hours & rates
- Fringe benefits/indirect charges
  - Approved rates
  - Provisional rates
- Equipment
  - Rent/purchase
  - Usage fee/cost
- Materials/supplies
- Other
  - Testing/evaluation
- Travel
  - Destination, purpose, number of persons, number of nights, estimated costs

12 projects selected from 59 proposals

Total Budget: $37M (42% in Cost Share)

	Focus Area	Project Team Leader
1	Degradation Resistant Materials (6 projects)	Caterpillar, MTI Mo-Sci, Penn State, Weyerhaeuser, WVU
2	Thermochemical Databases and Modeling (1 project)	OLI Systems
3	Materials for Separations	
4	Materials for Engineering Applications (5 projects)	Carpenter, EMC2, PPG Swagelok, Utah

Materials for Industrial Heat Recovery Systems (CPS# 16940)

Goal: Determine materials or changes in operating procedures that enhance the energy efficiency and reliability of industrial heat recovery systems.

Challenge: Identify corrosion mechanisms, alternate materials, and operational changes that can contribute to a 1.5% increase in the efficiency of recovery boilers and a 5X increase in recuperator tube life.

Benefits: Improved material durability resulting in longer operational life, fewer shutdowns, and increased yield and productivity. Improved operational efficiency resulting is a potential 12 trillion Btu/yr energy savings.

Status: in award negotiation process.

Partners: Weyerhaeuser Co., Oak Ridge National Laboratory, E3M Inc., IPST – Georgia Tech, PapriCan, Process Simulations Ltd., Secat Inc. B&W US & Canada, Domtar, Eclipse, Georgia Pacific, Kvaerner Power, MeadWestvaco, Sandvick Material Tech, Welding Services

Development of Functionally Graded Materials for Manufacturing Tools and Dies (CPS# 16941)

Goal: Develop new powder metallurgy based near-net-shape fabrication technologies for the creation of functionally graded tools, dies, and process equipment.

Challenge: Develop and demonstrate the ability to reliably and efficiently fabricate functionally graded materials by laser powder deposition (LPD) and solid state dynamic powder consolidation (SSDPC) methods and generate data that guides the selection and predicts the performance of the materials.

Benefits: Increased tooling life and superior elevated temperature properties of functionally graded materials can lead to reduced energy consumption by 120 trillion Btu/yr and reduced emissions by 2.3 million tons of CO_2 per year in metal casting, glass, and forging applications.

Solid State Dynamic Powder Consolidation Punch

Status: awarded 4/1/04.

Partners: Carpenter Powder Products Inc., Pacific Northwest National Laboratory, Techneglas Corporation, THT Presses Inc.,South Dakota School of Mines and Technology, Grenada Industries Inc., OPTOMEC, RPM and Associates Inc., GKN Sinter Metals R&D, Metaldyne Corporation,

Structurally Integrated Coatings for Wear and Corrosion (CPS# 16942)

Partners: Caterpillar Inc., Oak Ridge National Laboratory, Albany Research Center, University of Illinois, Iowa State University, QuesTek Innovations.

Goal: Develop cost effective surfacing materials and processes for improved wear and corrosion performance.

Challenge: Develop crack free and functionally graded coatings, containing borides and carbides, by 1) high intensity arc lamp fusing, 2) laser assisted thermal spray, 3) hybrid laser arc welding, and 4) plasma transferred arc welding techniques with wear and corrosion performance 4 to 8 times greater than that of current carburized steel.

Benefits: Reduced carburization treatments and the potential use of lightweight parts in heavy equipment may reduce energy consumption by 50% over existing technologies or 110 trillion Btu/yr by 2020.

Status: awarded 3/4/04.

Multifunctional Metallic and Refractory Materials for Energy Efficient Handling of Molten Metals (CPS# 16943)

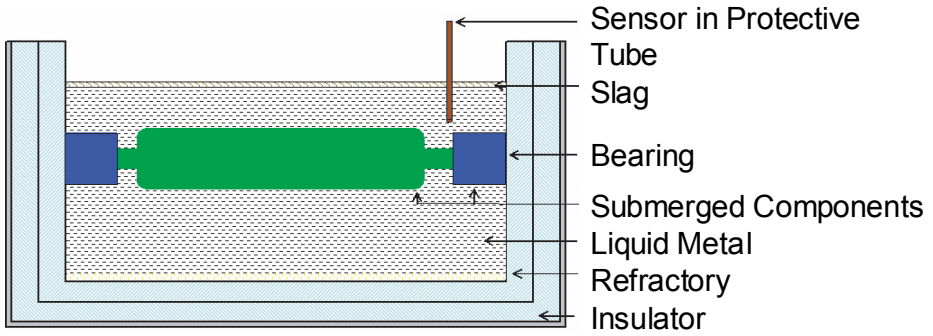
Goal: Extend the life of molten metal containment and submerged hardware and improve the thermal efficiency of molten metal containment.

Challenge: Develop multifunctional metallic and refractory materials and surface treatments, coatings, and claddings for life improvement of molten metal containment and submerged hardware and improved thermal management in aluminum, steel, metal casting, and other industries. Extend the life of the hardware by an order of magnitude.

Benefits: Increased energy efficiency, reduction of downtime and yield loss, improvement in product quality, reduced repair and replacement cost of corroded components resulting in potential energy savings of 333 trillion Btu/yr and cost savings of approximately $1 billion/yr by 2020.

Status: in negotiation.

Partners: West Virginia University, ORNL, EIO, Secat, Univ Missouri Rolla, plus 25 Industrial cost share partners.



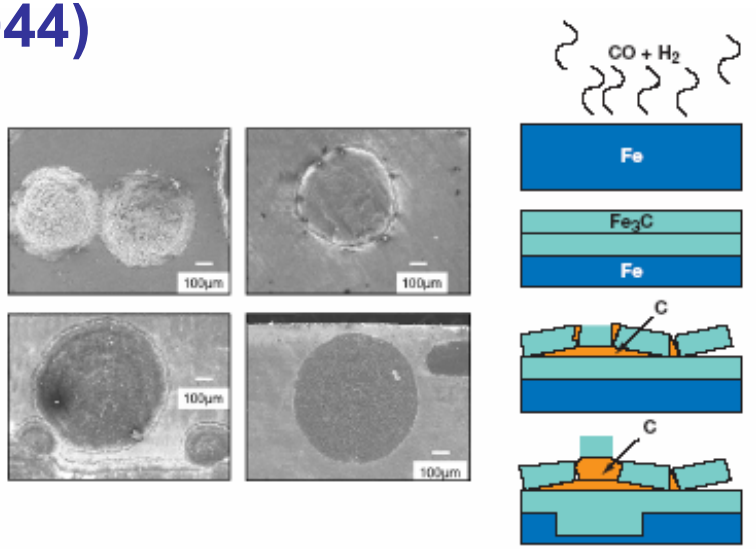
Development of Materials Resistant to Metal Dusting (CPS# 16944)

Goal: Develop metallic alloys and surface engineering of commercial alloys to mitigate metal dusting degradation.

Challenge: Develop materials to allow for the operation of reformers with improved efficiency, increased product yield, and decreased energy consumption while maintaining sufficient mechanical properties at temperatures up to 800 ºC.

Benefits: More efficient recovery of heat from effluent gas due to higher temperatures, extended life of reforming systems, and increased product yield due to decreased downtime.

Status: award in negotiation process.



Typical metal dusting damage and damage mechanism.

Partners: Materials Technology Institute, Argonne National Laboratory, Air Products, Alon, Conoco Philips, Dupont, ,Exxon Mobil., Haldor Topsoe, Haynes International, Sandvik, Special Metals, ThyssenKrupp VDM USA

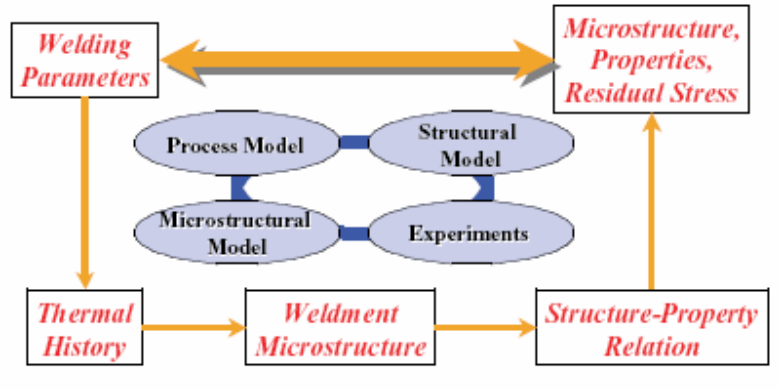
Advanced Integration of Multi-Scale Mechanics and Welding Process Simulation in Weld Integrity Assessment (CPS# 16945)

Goal: Develop assessment methodology for reliable and accurate evaluation of the integrity of welded structures such as joints in pipelines.

Challenge: Create 1) welding process modeling to provide detailed material property and residual stress data and 2) weld integrity assessment methodology from welding modeling, micromechanics, fracture mechanics, and damage mechanics analyses to conduct more accurate performance assessment of welded structures.

Benefits: Reduced defects, reduced costs, and energy savings in the fabrication of components.

Status: Awarded 3/3/04.



Partners: Engineering Mechanics Corporation of Columbus, Oak Ridge National Laboratory, Massachusetts Institute of Technology, Northwestern University, Pipeline Research Council International, Inc., Southern California Gas Company, Chevron Texaco

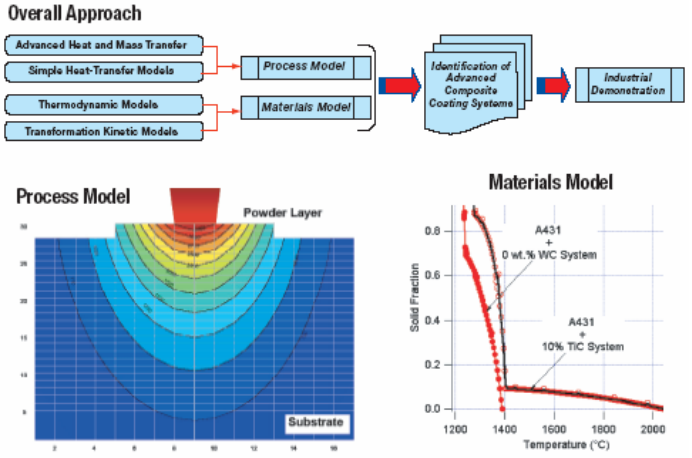
Advanced Wear and Corrosion Resistant Systems through Laser Surface Alloying and Materials Simulation (CPS# 16946)

Goal: Development and implementation of material simulation and processing techniques for identifying and creating coatings for increased component life.

Challenge: Create simulation and modeling methods for preparing composite coatings composed of hard carbides, borides, and nitrides within a metallic matrix by laser surface alloying processing. Include metallurgical bonding, thermal distortion, and microstructural features associated with improved wear, fatigue, creep, and corrosion resistance.

Benefits: Energy benefits and cost savings due to increased operational efficiency, extended component life, decreased downtime and superior performance. Energy benefits of up to 4 trillion Btu are estimated to accrue by 2020.

Status: awarded 4/29/04



Partners: Applied Research Laboratory Pennsylvania State University, Oak Ridge National Laboratory, Alstom Power, Inc., Alvord-Polk Corporation, Nuvonyx Inc., Praxair Surface Technologies, Inc., Spirex Corporation, Synergis Technologies Group

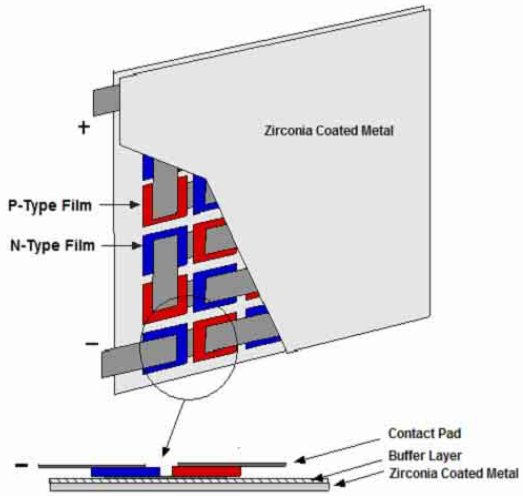
Thermoelectric Materials for Waste Heat Recovery (CPS# 16947)

Goal: Integrate advanced thermoelectric materials into thermoelectric device with efficiency >20%.

Challenge: Multi-layered, thin-film materials show promise for thermoelectric performance but lack sufficient robustness and economical scalability for industrial application.

Benefits: Recovery of energy from industrial waste heat stacks; conversion of waste heat into electrical power; energy savings of 1.6 trillion Btu/year in 2020.

Status: award in negotiation process.



Schematic of thin film material configuration

Partners: PPG Industries, Pacific Northwest National Laboratory, J. Johnson - Michigan Technological University, Leadbetter, Alcoa, Owens-Illinois,.

Low Temperature Surface Carburizing of Stainless Steels (CPS# 16948)

Goal: Achieve stainless steel component life enhancement by surface modification.

Challenge: Develop a low temperature (450 to 500 ºC) carburization technique to produce super saturation of carbon interstitials in stainless steel alloys resulting in a hardness > 1000 HV (R_c-70), 50% reduction in wear rates, and 2X improvement in resistance to pitting, crevice and stress corrosion.

Benefits: Reduction of service induced corrosion and wear in pumps, thus improving productivity and efficiency, resulting in a potential 22 trillion Btu/yr energy savings by 2020.

Status: awarded 4/14/04.

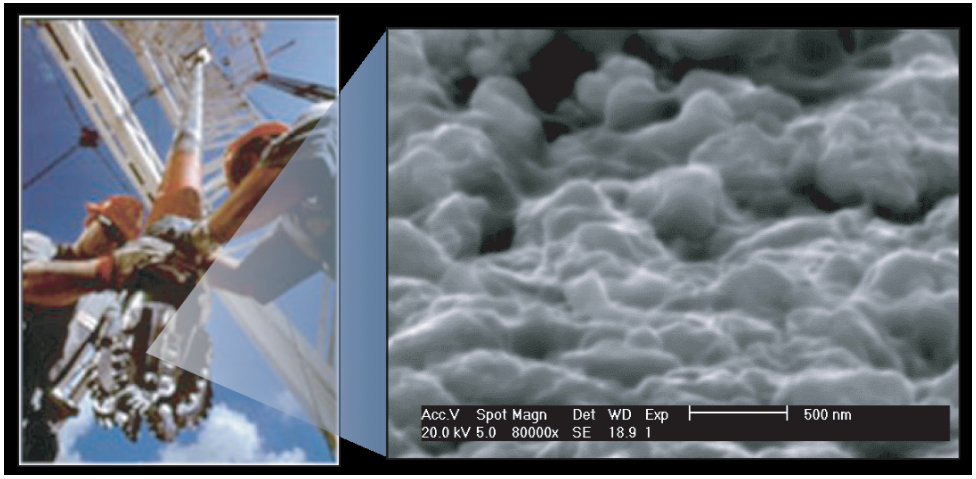
Pressure Powered Pump

Partners: Swagelok Company, Oak Ridge National Laboratory, Case Western Reserve University, Energy Industries of Ohio, Spirax Sarco Inc.

Development of Bulk, Nanocrystalline Tungsten Carbide for Industrial Applications (CPS# 16949)

Goal: Develop a process for manufacturing nanocrystalline cemented tungsten carbide materials that will provide improved wear resistant characteristics for tools.

Challenge: Create powder synthesis and consolidation processes to enable the fabrication of nanocrystalline WC/Co to true nanometer grain sizes (< 100 nm) using an ultrahigh pressure rapid heating and consolidation process.



Benefits: The WC/Co powder synthesis and consolidation processes are expected to consume less energy than conventional fabrication methods plus the increased lifetime of the fabricated tools will result in less process downtime.

Status: awarded 3/24/04.

Partners: University of Utah, Idaho National Engineering and Environmental Laboratory, Kennametal, Inc., Smith International, Inc.

Prediction of Corrosion of Advanced Materials and Fabricated Components (CPS# 16950)

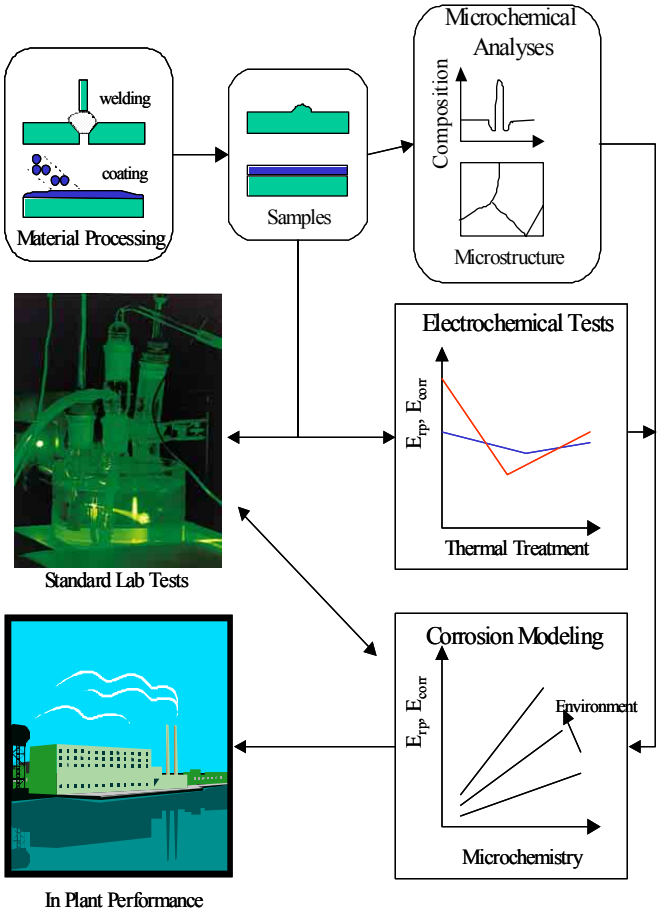
Goal: Ability to predict susceptibility of metallic components to corrosion in-service.

Challenge: Develop model to predict the corrosion of fabricated alloys in industrial environments, allowing for more efficient materials design and selection.

Benefits: Energy savings associated with improved corrosion inhibition strategies and more efficient process operation.

Status: awarded 2/3/04.

Partners: OLI Systems, Inc., Southwest Research Institute, Chevron Texaco Exploration and Production Technology Co., Dupont Engineering Technology, Haynes International Inc., Mitsubishi Chemical Corp., Shell Global Solutions Inc., Toyo Engineering Corp.



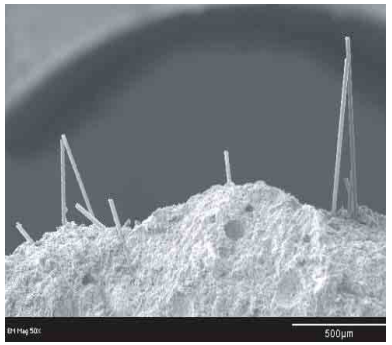
High Strength / High Alkaline Resistant Fe-Phosphate Glass Fibers as Concrete Reinforcement (CPS# 16951)

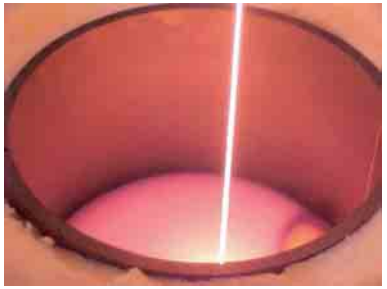
Goal: Improve the durability of concrete composites by developing a reinforcement material that has improved chemical resistance compared to steel reinforcement and silica glass fibers.

Challenge: Demonstrate that Fe-phosphate glass fiber reinforcement can replace steel in concrete composites. Optimize the Fe-phosphate glass composition for maximum mechanical and chemical resistance.

Benefits: Potential reduction in energy in the processing of Fe-phosphate fibers compared to existing concrete reinforcement materials.

Continuous Glass Fiber


Cement with Reinforcing Glass Fibers


Glass Melting

Status: awarded on 4/27/04

Partners: Mo-Sci Corp., University of Missouri-Rolla, AGY LLC.